



What are the health and greenhouse gas implications of travel patterns in different European settings?

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Centre for Diet and Activity Research
A UKCRC Public Health Research Centre of Excellence

What are the health and greenhouse gas implications of travel patterns in different European settings?

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Schwanen T: Transport Studies Unit, Oxford University

Modelling Tool

ITHIM: Integrated Transport and Health Impact Modelling Tool

Created by James Woodcock CEDAR, University of Cambridge
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Implemented in Analytica by James Woodcock & Marko Tainio
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The
model

Acknowledgements
in development of
ITHIM
Zaid Chalabi
Phil Edwards
Neil Maizlish
Marko Tainio

Burden summary

Calc



Sensitivity analysis

Calc

mid

Expert Data Entry

Physical activity data entry

Time min per week (minutes per week) [Edit Table](#)

Mean speed km/h (km/h) [Edit Table](#)

Cycling Travel Time Ratios [Edit Table](#)

Proportion of pop cycling on 1 day (fraction) [Edit Table](#)

Walking Travel Time Ratios (Ratios) [Edit Table](#)

Simple data entry click here

CO2 & PM 2.5 emission factors

Emission factors by Mode by Road Type [Edit Table](#)

CO2 emissions (mt CO2 per yr) [Calc](#) mid

Injury data entry

Age and sex ratios baseline for motorised transport [Edit Table](#)

Baseline fatalities [Edit Table](#)

Demographic Relative Risks Victim [Edit Table](#)

Demographic Relative Risks Striking [Edit Table](#)

Fatalities & injuries summary including age & gender [Calc](#) mid

ITHIM

- World Health Organization 2010 data for every country
- Weighted measure of health burden, compared against age specific 'ideal' life expectancy
- Disability Adjusted Life Year (DALY)
- Years of Life Lost (YLL)
- Years of Healthy Life Lost due to Disability (YLD)

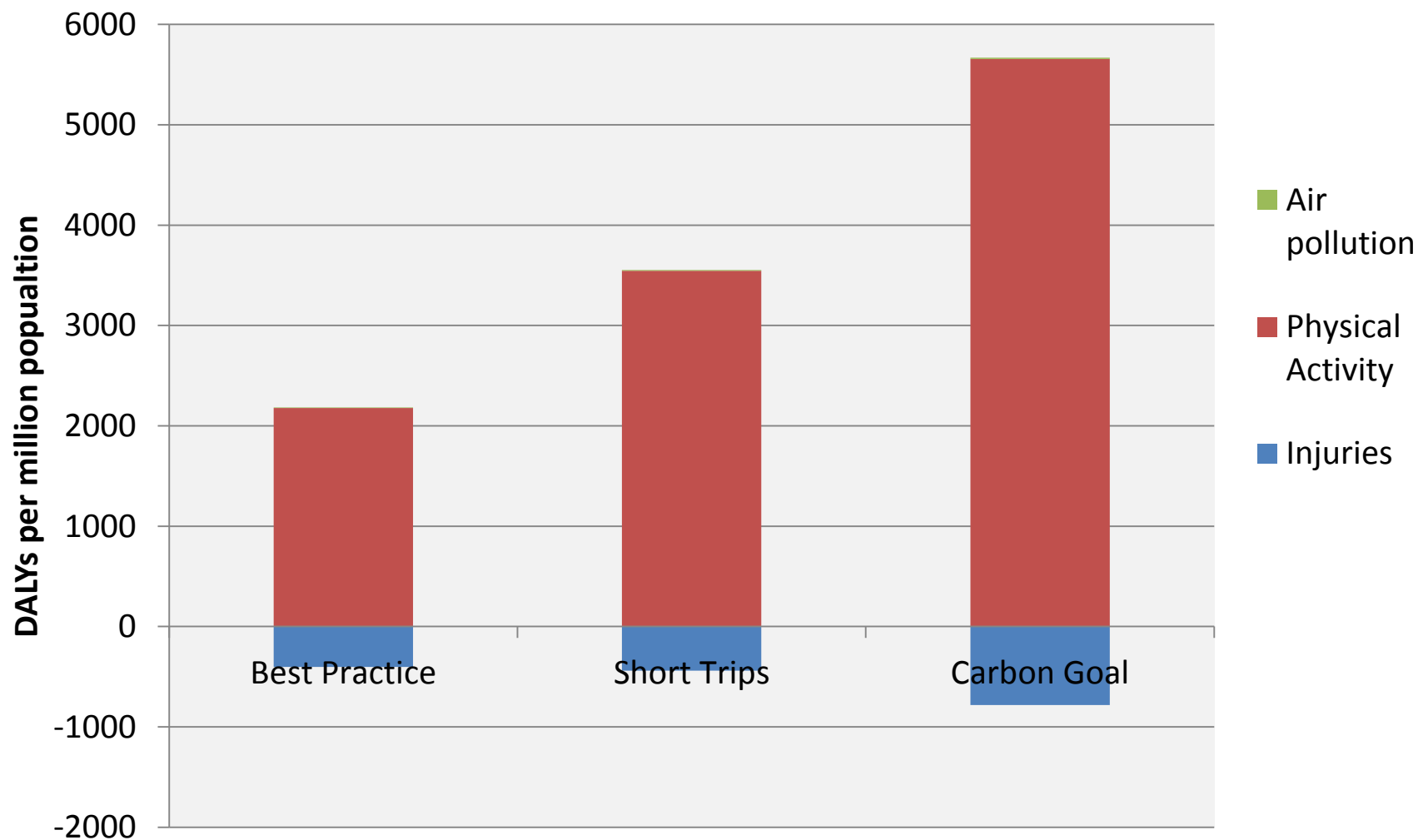
$$\text{DALY} = \text{YLL} + \text{YLD}$$

California Bay Area

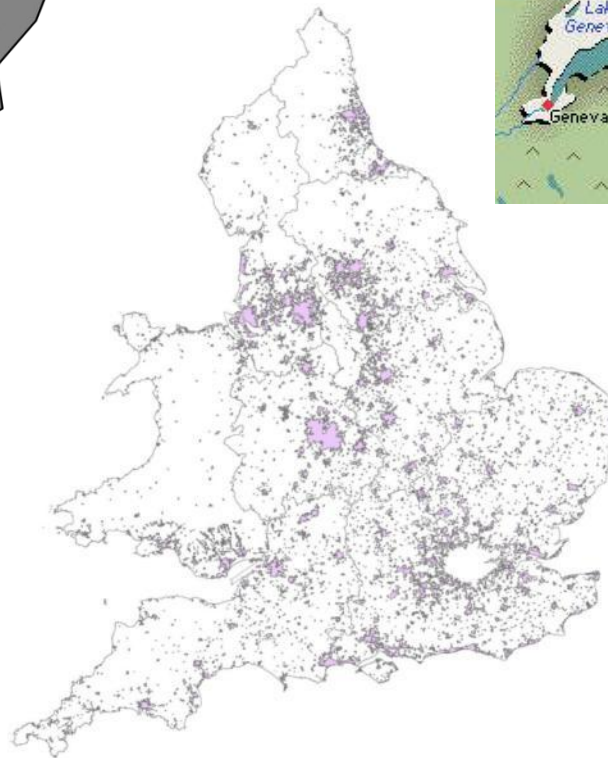


Maizlish N, **Woodcock J**, Co S, Ostro B, Fanai A, Farley D. Health Co-Benefits and Transportation-Related Reductions in Greenhouse Gas Emissions in the Bay Area: Technical Report. California Department of Public Health, November 2011.
[Centre for Diet and Activity Research](#)

California Bay Area



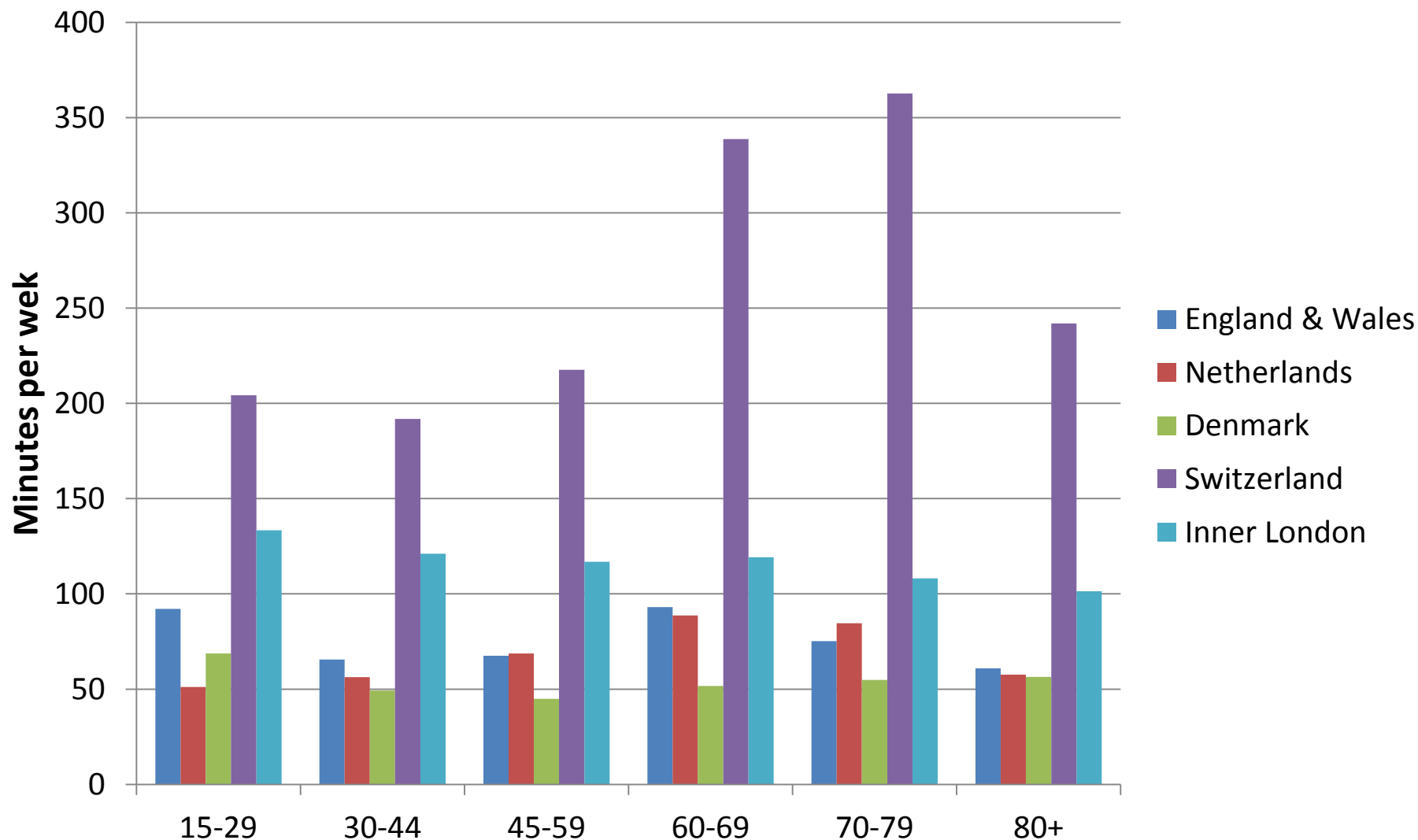
Modelling Impact of Geographical Variation



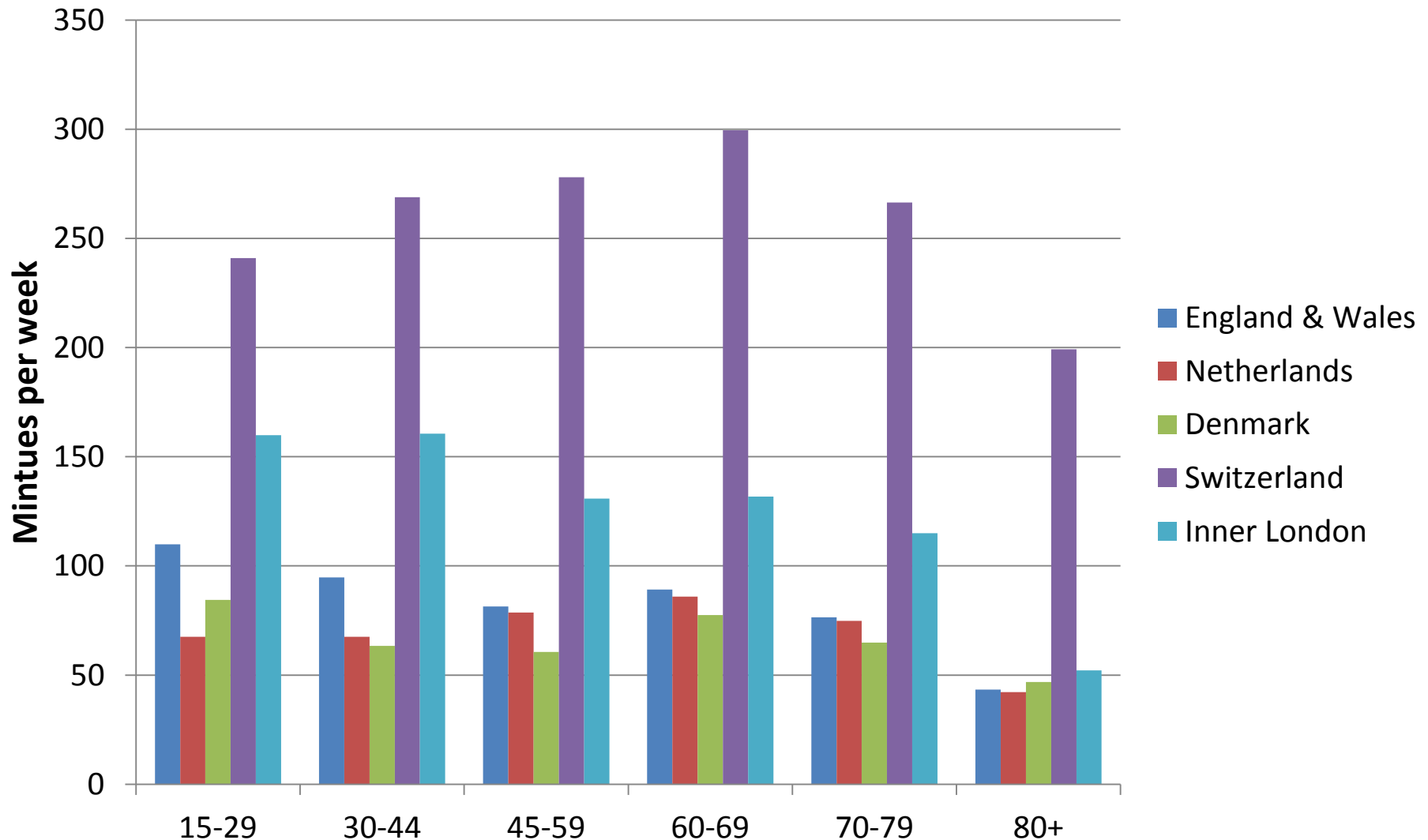


	England & Wales (urban)	Netherlands (urban)	Denmark (urban)	Switzerland (urban)	London
Years	2002-2008 analysed	2005	2006	2005	2005-2008
Sample Size (approx)	80,000 people	35,000 people	7,000 people	30,000 people	12,000 people
Length of survey	7 day travel diary but walking trips <1 mile only on 1 day	1 day travel diary	1 day travel diary	1 day travel diary	1 day travel diary
Population covered (urban)	40 million	13.7 million	4.7 million	5.7 million	2.9 million
Walking trip	250 metres	250 metres	250 metres	250 metres	250 metres
Time & distance estimated by	Self-reported time & distance	Self-reported time & distance	Self-reported time and distance, but telephone support	Self-reported time & distance	Self-reported time. Point to point distance

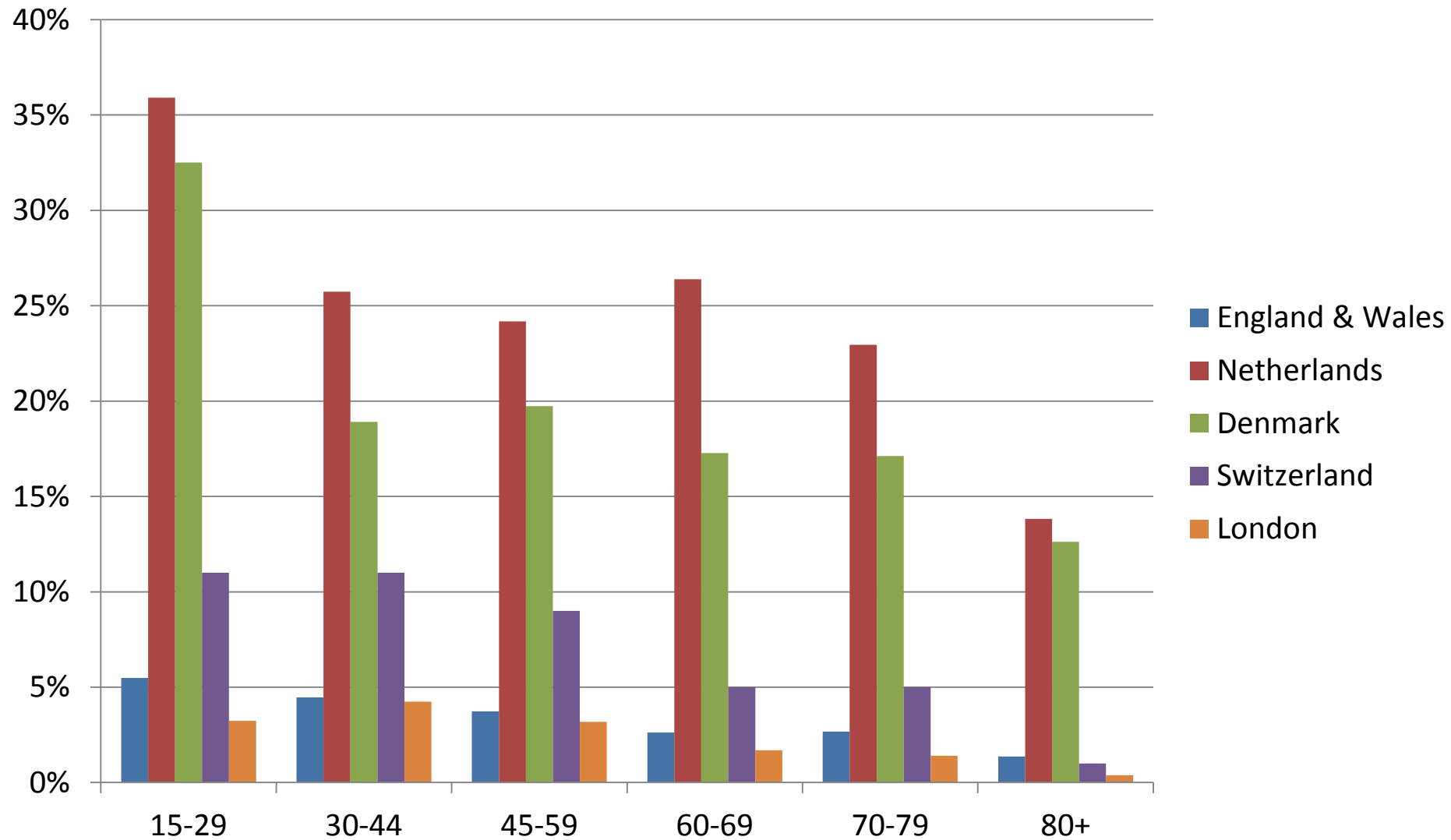
Walking: minutes per week men



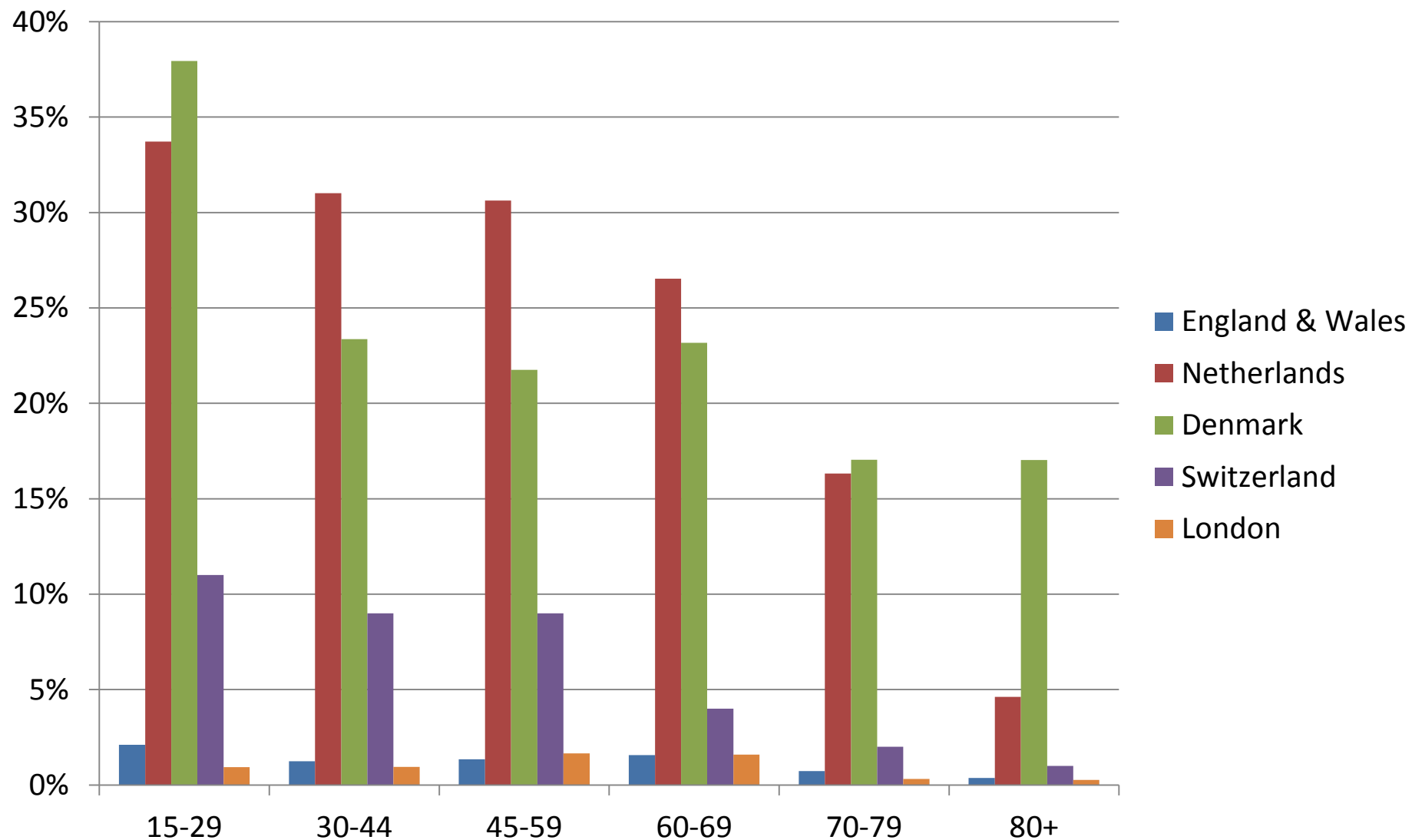
Walking: minutes per week women



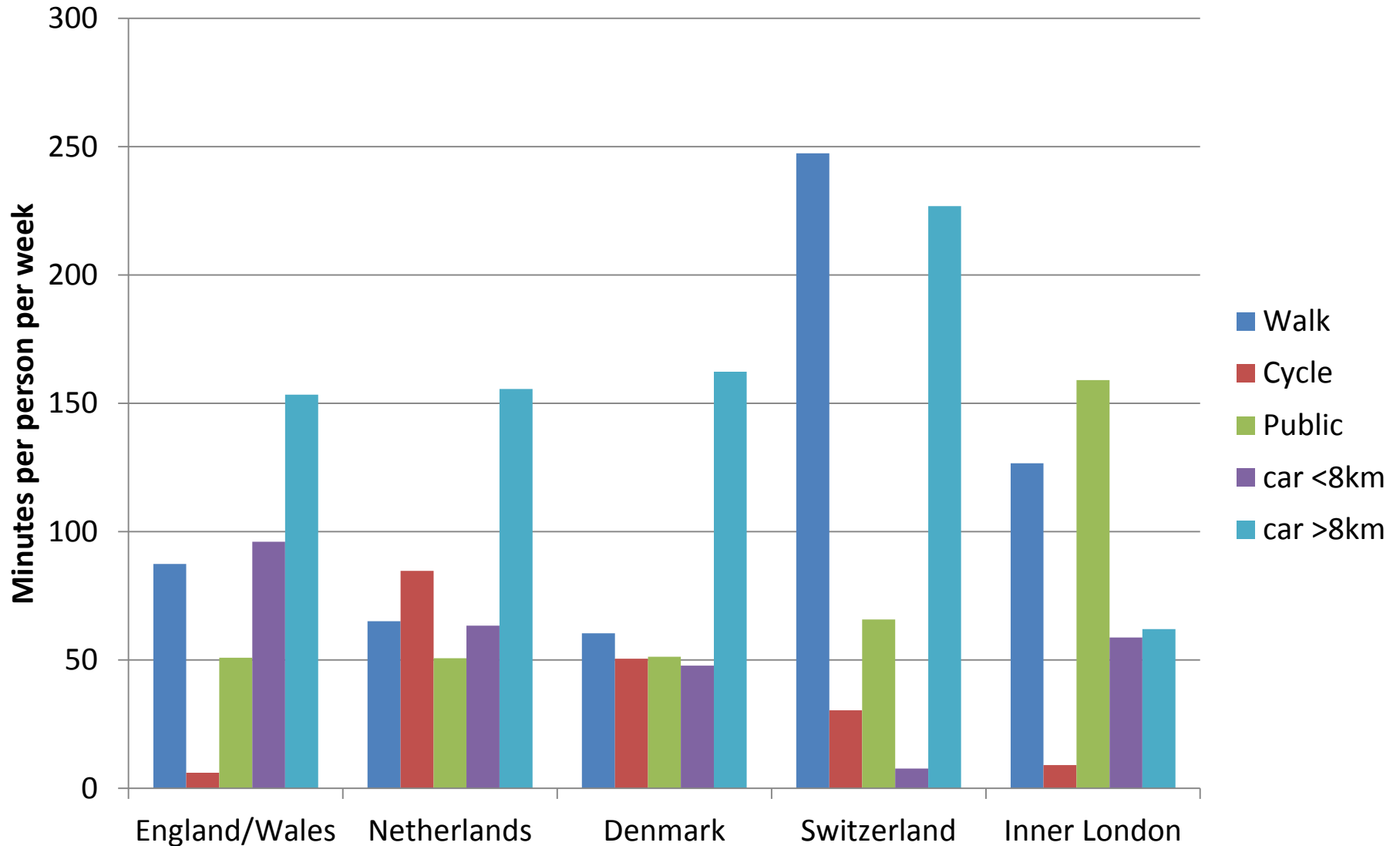
% cycling on one day men



% cycling on one day women



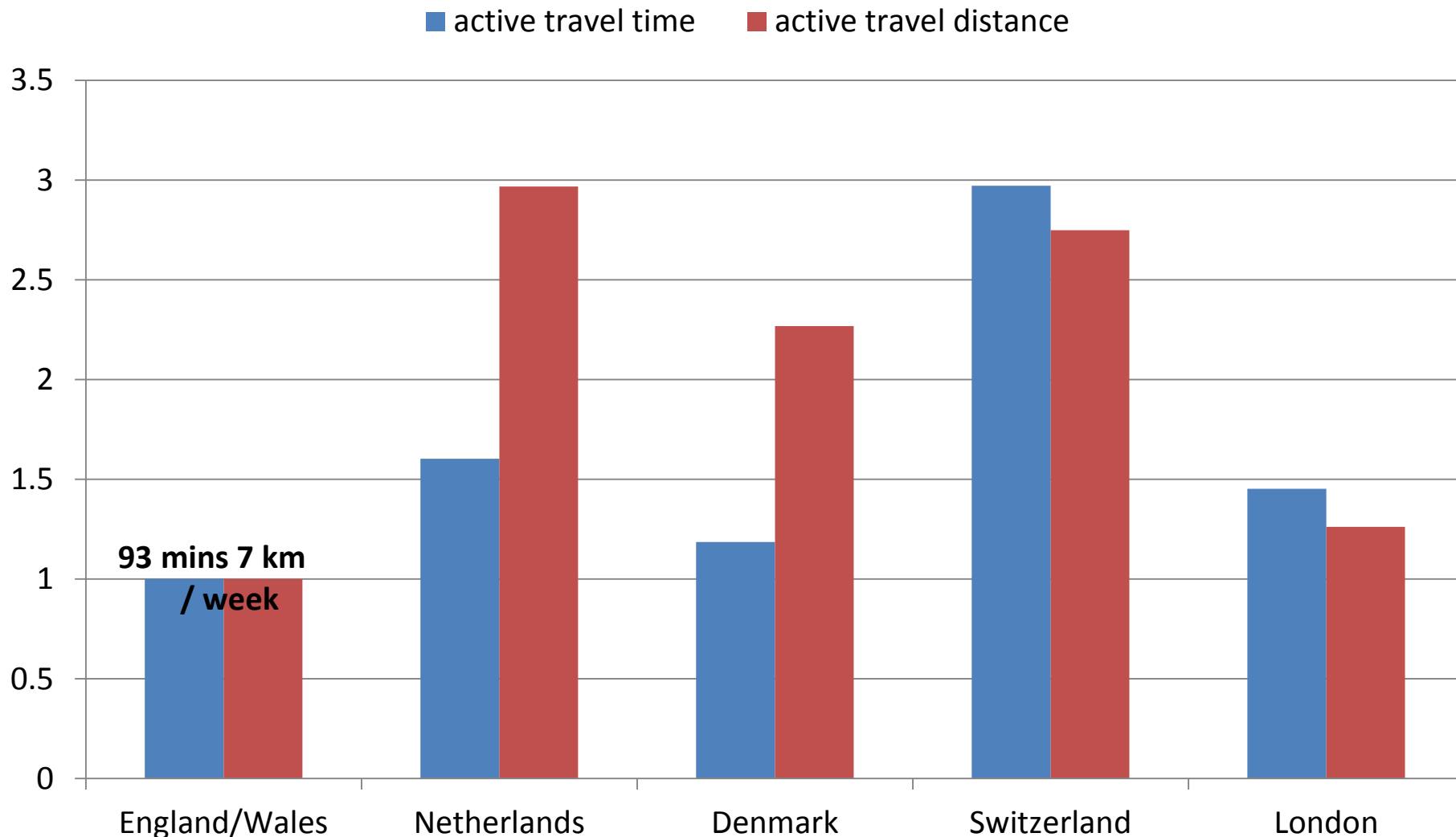
Mode split: time



Car km



Relative time & distance active travel

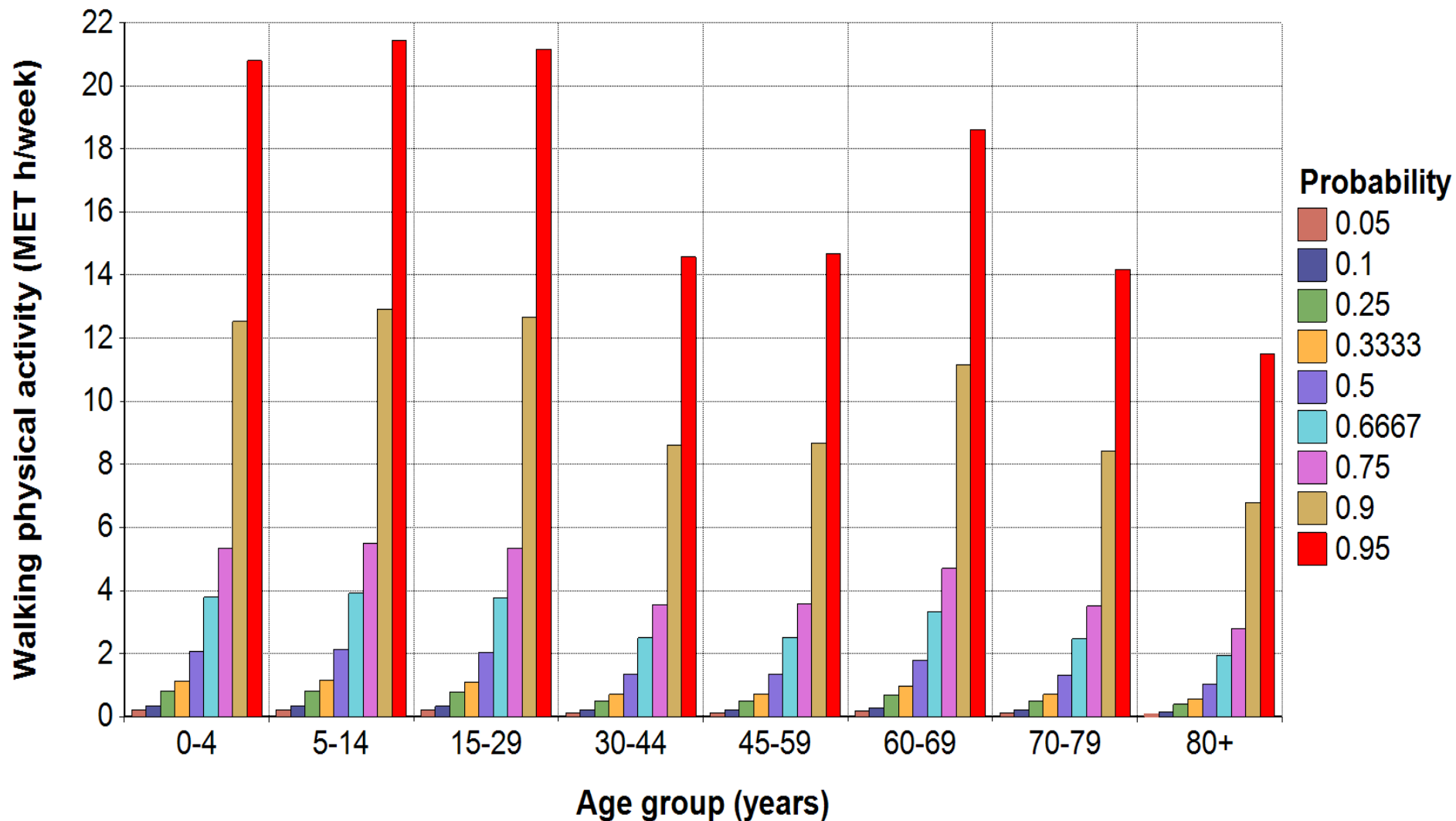


Metabolically Equivalent Tasks (METs)

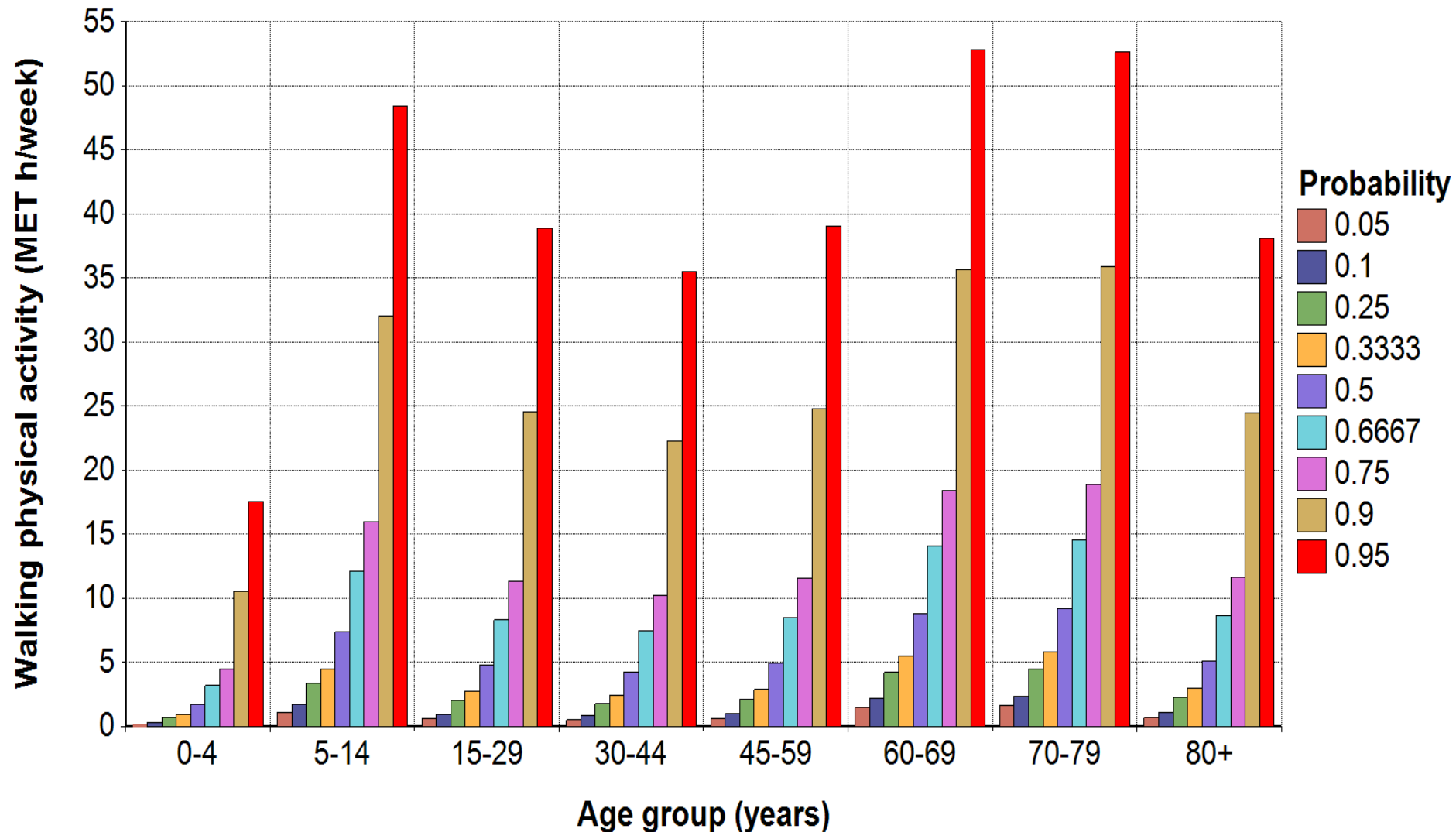
- Mass adjusted measure of energy expenditure

3.0	walking, 2.5 mph, level, firm surface
3.3	walking, 2.5 mph, downhill
3.5	walking, 2.8 to 3.2 mph, level, moderate pace, firm surface
4.3	walking, 3.5 mph, level, brisk, firm surface, walking for exercise
7.5	bicycling, general
3.5	bicycling, leisure, 5.5 mph
5.8	bicycling, leisure, 9.4 mph
6.8	bicycling, 10-11.9 mph, leisure, slow, light effort
8.0	bicycling, 12-13.9 mph, leisure, moderate effort
10.0	bicycling, 14-15.9 mph, racing or leisure, fast, vigorous effort

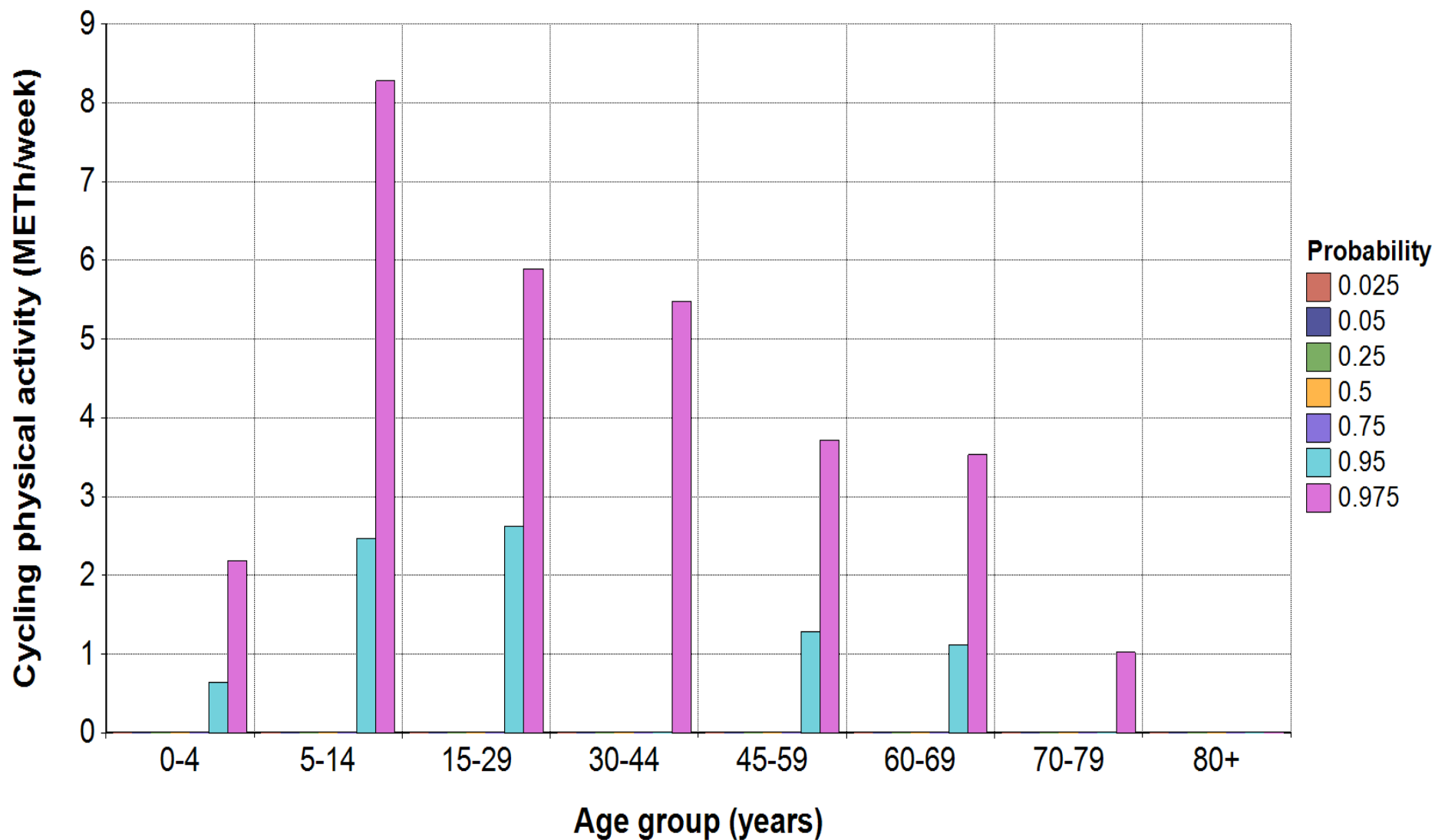
Variation weekly walking energy expenditure: England & Wales men



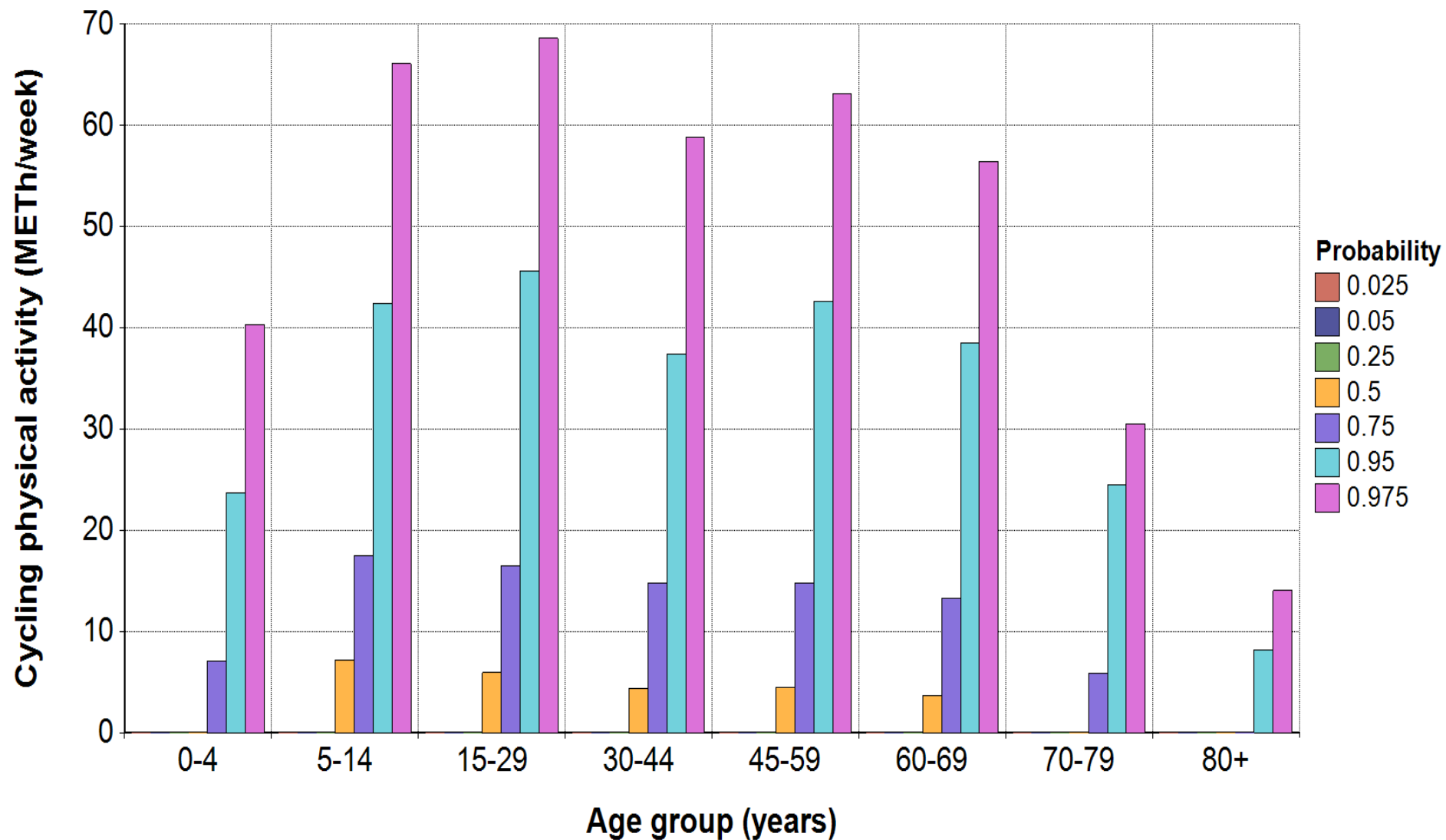
Swiss: men walking distribution



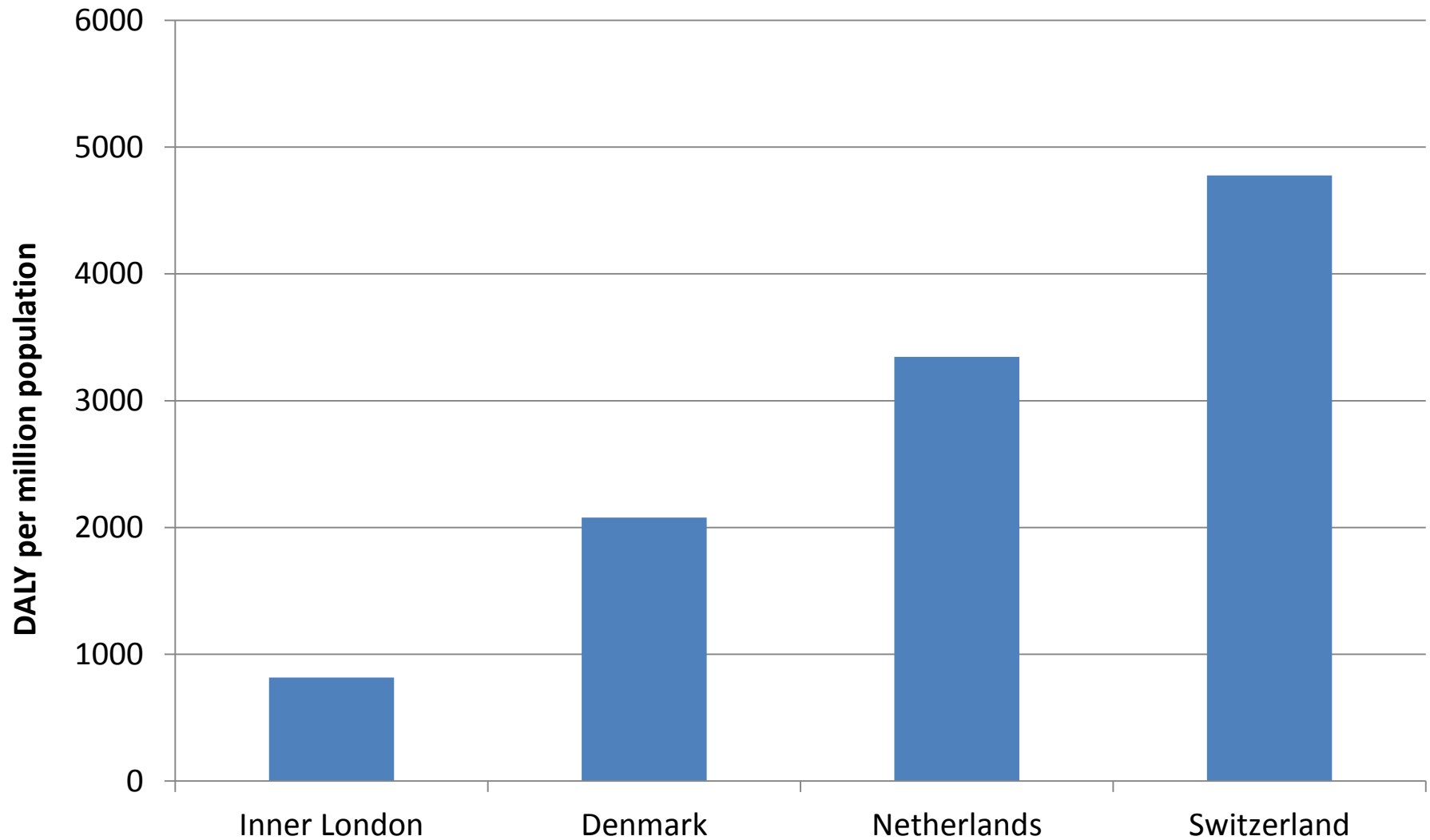
England & Wales: women cycling distribution



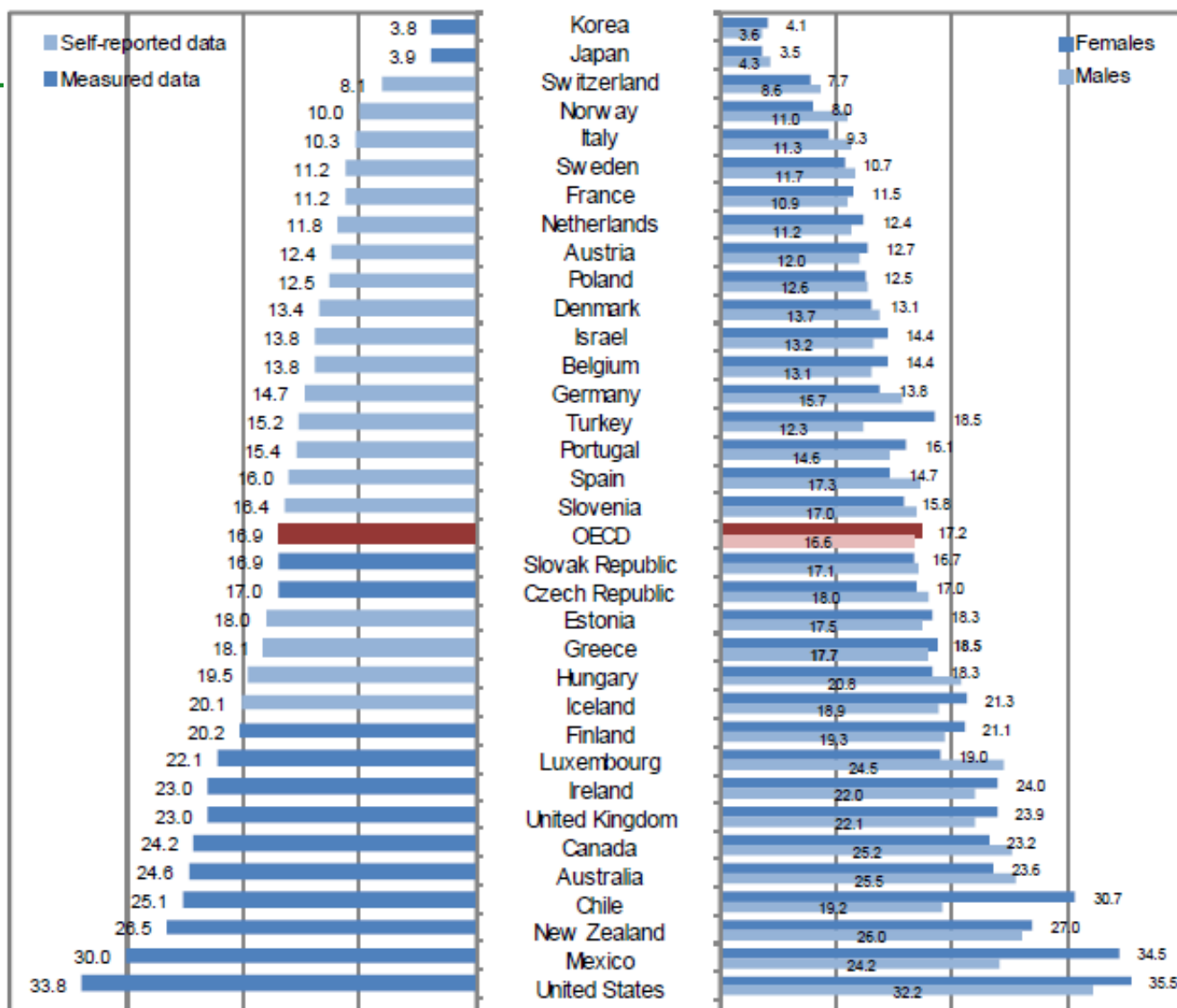
Netherlands: women cycling distribution



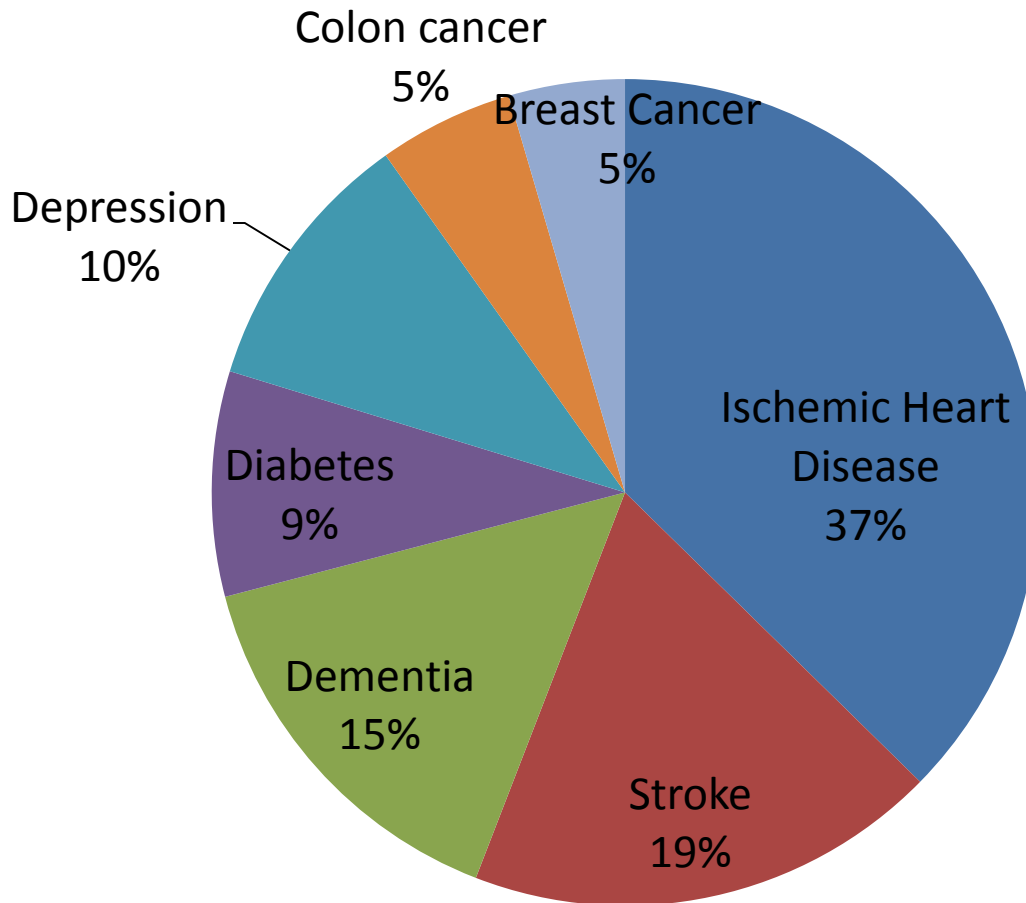
Health gains across settings



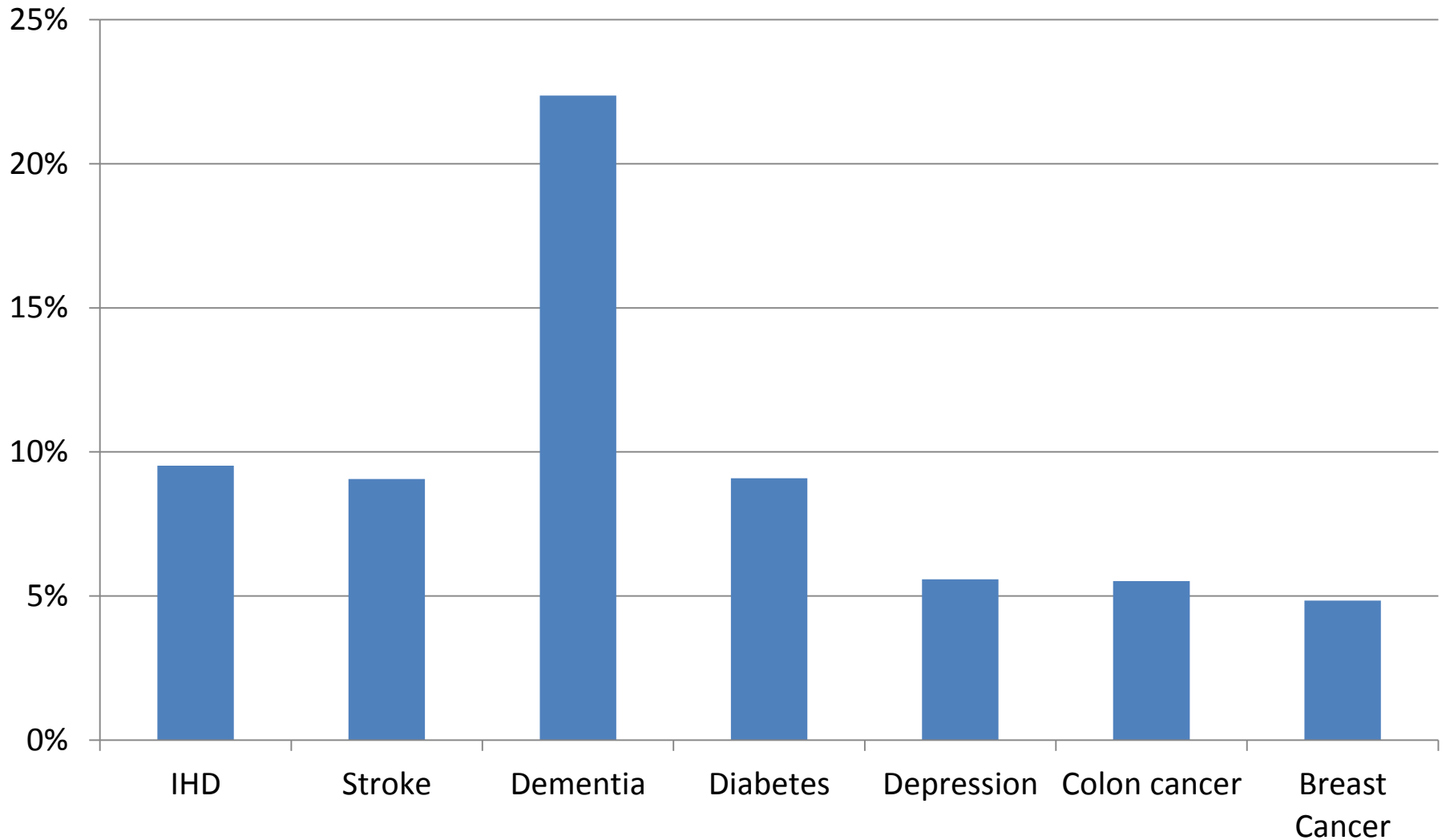
Obesity rates adults 2009



Netherlands: contribution of disease to reduction in total burden



Switzerland: % reductions by disease



Conclusions

- Impact of differences on health large
- Co-benefits not automatic
- How can we achieve both?

Next Steps



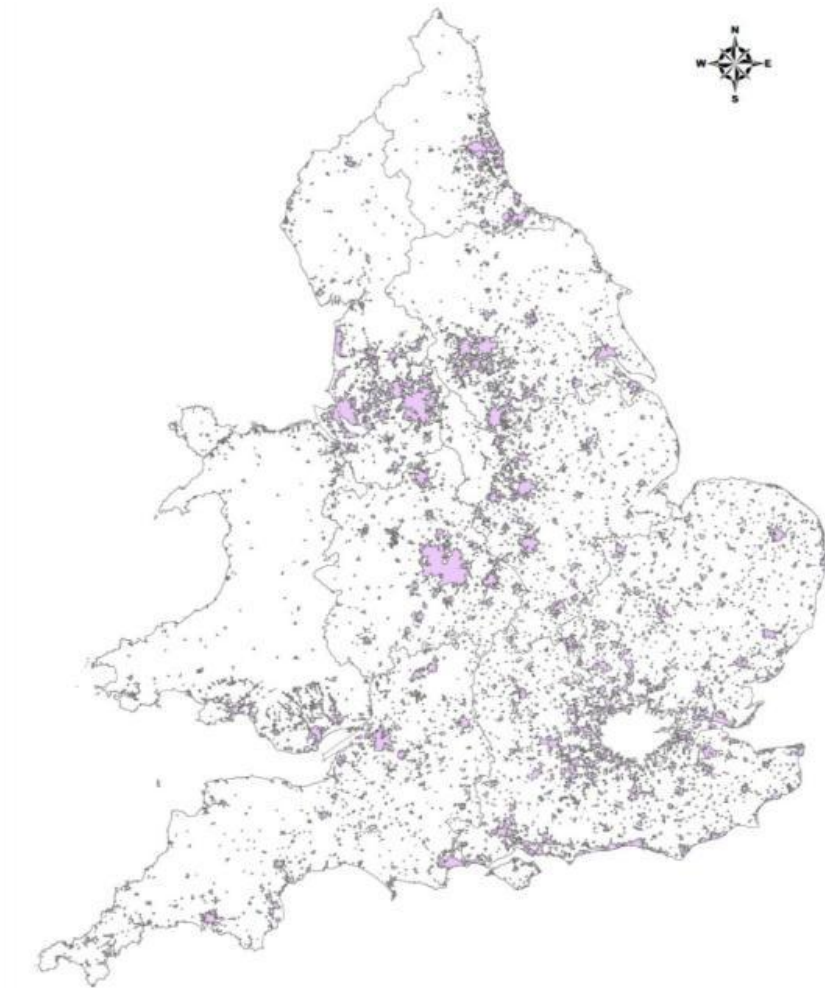
ACKNOWLEDGEMENT

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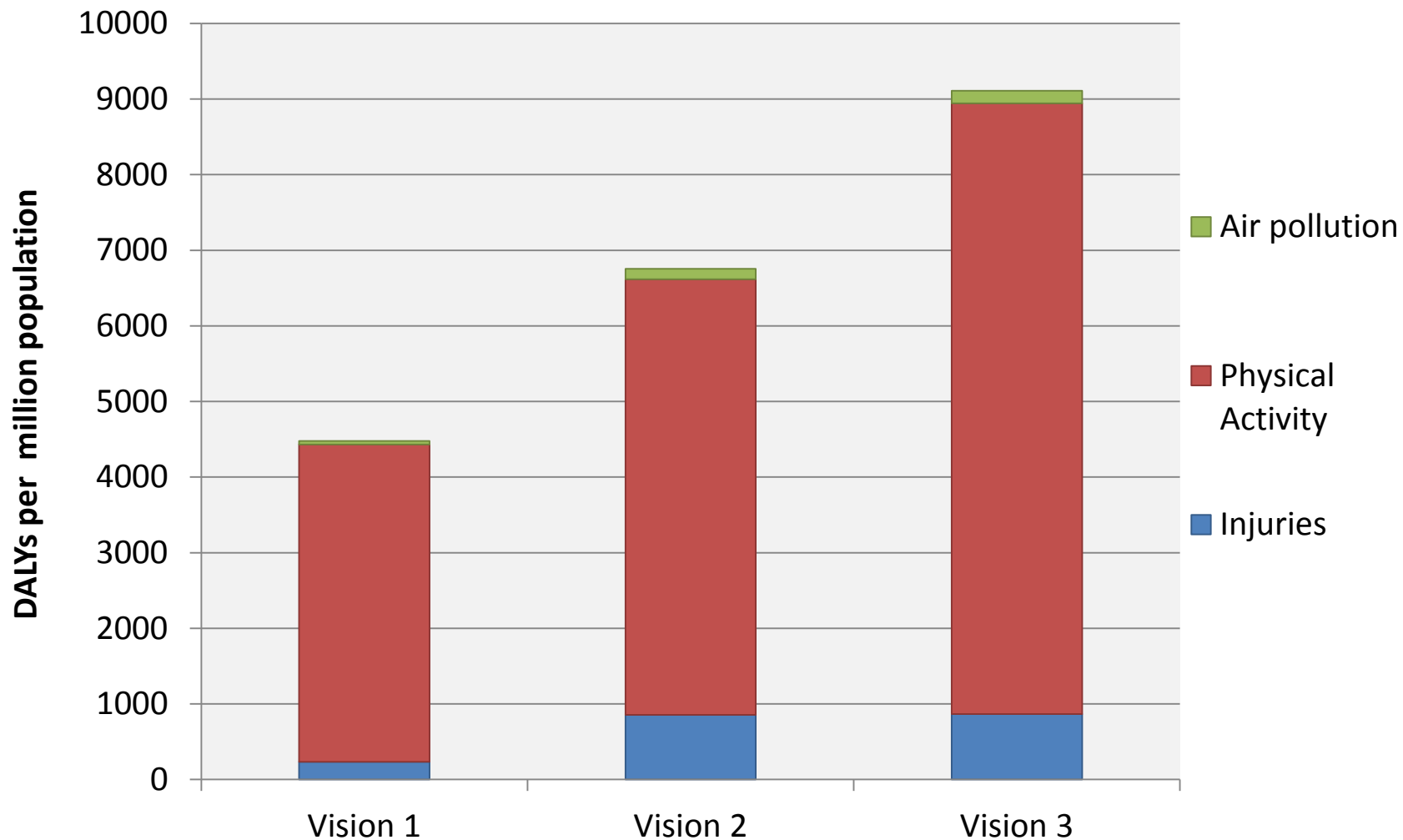
Funding from the British Heart Foundation, Economic and Social Research Council, Medical Research Council, the National Institute for Health Research, and the Wellcome Trust, under the auspices of the UK Clinical Research Collaboration, is gratefully acknowledged.



England & Wales Scenarios



England & Wales Results



English and Welsh urban areas (outside London)

Scenario3

(enter 4 if you want to enter new values)

Person travel time, speeds and distance

		Eng/Wales		Vision 1		Vision 2		Vision 3		Data entry (4)		Scenario		
		Baseline(0)												
Time (minutes per day)	walk	12.5	22%	14.1	24%	16.8	28%	21.6	35%	70.0	45%	21.6	35%	
	cycle	0.9	2%	6.4	11%	9.5	16%	18.2	30%	40.0	26%	18.2	30%	
	bus	4.6	8%	6.9	11%	15.8	27%	9.6	16%	4.6	3%	9.6	16%	
	minibus	0.5	1%	2.9	5%	6.3	11%	1.3	2%	0.5	0%	1.3	2%	
	train	1.8	3%	4.0	7%	6.6	11%	5.1	8%	1.8	1%	5.1	8%	
	car <8km	13.7	24%	7.2	12%	1.1	2%	1.3	2%	11.0	7%	1.3	2%	
	car >8km	21.9	39%	16.1	28%	2.3	4%	2.4	4%	26.0	17%	2.4	4%	
	mbike	0.1	0%	0.2	0%	0.2	0%	0.3	0%	0.2	0%	0.3	0%	
Mean speed (kmph)	elec bike	0.1	0%	0.3	1%	0.8	1%	1.5	2%	0.1	0%	1.5	2%	
	total	56.2	100%	58.1	100%	59.5	100%	61.2	100%	154.2	100%	61.2	100%	
	walk	4.3		4.6		4.9		5.2		4.3		5.2		
	cycle	11.8		13.0		14.0		16.0		11.8		16.0		
	bus	23.0		26.0		23.0		23.0		23.0		23.0		
	minibus	13.0		13.0		13.0		13.0		13.0		13.0		
	train	60.1		45.0		50.0		45.0		60.1		45.0		
	car <8km	20.5		18.0		15.0		15.0		20.5		15.0		
Distance (km per day)	car >8km	50.7		51.0		50.0		35.0		50.7		35.0		
	mbike	42.0		38.0		35.0		30.0		42.0		30.0		
	elec bike	11.8		12.0		13.0		14.0		11.8		14.0		
	walk	0.9	3%	1.1	4%	1.4	7%	1.9	11%	5.0	12%	1.9	11%	
	cycle	0.2	1%	1.4	6%	2.2	12%	4.8	29%	7.9	19%	4.8	29%	
	bus	1.8	6%	3.0	11%	6.1	31%	3.7	22%	1.8	4%	3.7	22%	
	minibus	0.1	0%	0.6	3%	1.4	7%	0.3	2%	0.1	0%	0.3	2%	
	train	1.8	6%	3.0	11%	5.5	29%	3.9	23%	1.8	4%	3.9	23%	
Coefficient of var	car <8km	4.7	17%	2.2	9%	0.3	1%	0.3	2%	3.8	9%	0.3	2%	
	car >8km	18.5	66%	13.7	55%	1.9	10%	1.4	8%	22.0	52%	1.4	8%	
	mbike	0.2	1%	0.1	0%	0.1	1%	0.1	1%	0.2	0%	0.1	1%	
	elec bike	0.0	0%	0.1	0%	0.2	1%	0.3	2%	0.0	0%	0.3	2%	
	total	28.1	100%	25.1	100%	19.0	100%	16.7	100%	42.5	100%	16.7	100%	
	CO2	100%	82%	46%	39%	105%	39%							
	Physical Activity Risk Function (power 0.25=0, power 0.5= 1, power 0.375=2, log=3, linear=4)	1												
	Air Pollution: Mean PM urban areas England and Wales													
population	10.3	10.1	9.6	9.4	10.2	9.4								

Results

	Breast Cancer		Colon Cancer		Ischemic Heart Disease		Depression		Dementia		Diabetes		Stroke		Road Traffic Injuries		All-cause mortality Woodcock	
Age	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f
15-29	0%	-5%	-5%	-5%	-15%	-15%	-3%	-4%	-4%	-6%	-14%	-14%	-15%	-15%	-49%	-24%	-3%	-4%
30-44	0%	-4%	-4%	-4%	-16%	-15%	-5%	-6%	-4%	-5%	-15%	-14%	-16%	-15%	-28%	-15%	-2%	-4%
45-59	0%	-4%	-5%	-4%	-16%	-18%	-6%	-7%	-4%	-5%	-15%	-17%	-16%	-18%	-15%	10%	-3%	-4%
60-69	0%	-7%	-8%	-7%	-16%	-16%	-9%	-12%	-7%	-9%	-15%	-15%	-16%	-16%	11%	18%	-5%	-10%
70-79	0%	-6%	-10%	-6%	-15%	-14%	-11%	-10%	-9%	-8%	-14%	-13%	-15%	-14%	-20%	12%	-9%	-9%
80+	0%	-6%	-9%	-6%	-13%	-13%	-10%	-10%	-7%	-8%	-12%	-13%	-13%	-13%	0%	-4%	-10%	-10%
total	-5%	-7%	-7%	-7%	-15%	-15%	-6%	-6%	-8%	-8%	-15%	-15%	-15%	-15%	-30%	-30%	-7%	-7%
Total DALYs	-245,056		-2.8%		CO2		-61.5%											

Populatoin Desnity Function

Minutes per day of active travel